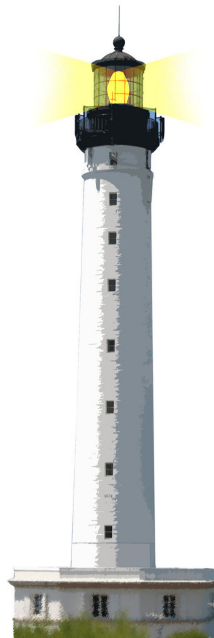
Advanced Object-Oriented Design

Pharo Syntax in a Nutshell

http://www.pharo.org



Getting a feel about syntax

Give you the general feel to get started:

- Overview of syntactical elements and constructs
- Three kinds of messages to minimize parentheses
- Overview of block syntax

This lecture is an **overview**
No stress if you do not get it right now!
We will repeat in future lectures

The complete syntax on a postcard

No need to understand everything! But "everything" is on this screen :)

```
exampleWithNumber: x
 "This method illustrates the complete syntax."
 <aMethodAnnotation>

 | y |
 true & false not & (nil isNil)
  ifFalse: [ self halt ].
 y := self size + super size.
 #($a #a 'a' 1 1.0)
  do: [ :each | Transcript
         show: (each class name);
         show: (each printString);
         show: ' ' ].
 ^ x < y
```

Hello world

```
'Hello World' asMorph openInWindow
```

We send the message asMorph to a string and obtain a graphical element that we open in a window by sending it the message openInWindow

Getting the Pharo logo from the web

```
(ZnEasy getPng: 'http://pharo.org/web/files/pharo.png')
  asMorph openInWindow
```

- ZnEasy designates a class
  - Class names start with an uppercase character
- Message getPng: is sent to the ZnEasy class with a string as argument
  - getPng: is a keyword message
- ’http://pharo.org/web/files/pharo.png’ is a string
- Messages asMorph and openInWindow are executed from left to right

Syntactic elements

comment	"a comment"
character	$c $# $@
string	’lulu’ ’l”idiot’
symbol (unique string)	#mac #+
literal array	#(12 23 36)
integer	1, 2r101
real	1.5 6.03e-34,4, 2.4e7
boolean	true, false (instances of True and False)
undefined	nil (instance of UndefinedObject)
point	10@120

Essential constructs

- Temporary variable declaration: | var |
- Variable assignment: var := aValue
- Separator: message . message
- Return: ^ expression
- Block (lexical closures, a.k.a anonymous method)

```
[ :x | x + 2 ] value: 5
> 7
```

Essence of Pharo computation

- Objects (created using messages)
- Messages
- Blocks (anonymous methods)

Three kinds of messages to minimize parentheses

- Unary message
  - **Syntax:** receiver selector
  - 9 squared
  - Date today
- Binary message
  - **Syntax:** receiver selector argument
  - 1+2
  - 3@4
- Keyword message
  - **Syntax:** receiver key1: arg1 key2: arg2
  - 2 between: 10 and: 20

Message precedence

(Msg) > Unary > Binary > Keywords

- First we execute ()
- Then unary, then binary and finally keyword messages

This order minimizes () needs
But let us start with messages

Sending an unary message

```
receiver selector
```

Example

```
10000 factorial
```

We send the message `factorial` to the object `10000`

Sending a binary message

```
receiver selector argument
```

Example

```
1 + 3
```

We send the message `+` to the object `1` with the object `3` as argument

Sending a keyword message

```
receiver keyword1: arg1 keyword2: arg2
```

equivalent to C like syntax

```
receiver.keyword1keyword2(arg1, arg2)
```

Example: Sending an HTTP request

```
ZnClient new
 url: 'https://en.wikipedia.org/w/index.php';
 queryAt: 'title' put: 'Pharo';
 queryAt: 'action'  put: 'edit';
 get
```

- new is a unary message sent to a class
- url:, queryAt:put: are keyword messages
- get is a unary message
- ; (called a cascade) sends all messages to the same receiver

Messages are everywhere!

- Conditionals
- Loops
- Iterators
- Concurrency

Conditionals are also message sends

```
factorial
  "Answer the factorial of the receiver."
  self = 0 ifTrue: [ ^ 1 ].
  self > 0 ifTrue: [ ^ self * (self - 1) factorial ].
  self error: 'Not valid for negative integers'
```

- `ifTrue:` is sent to an object, a boolean!
- `ifFalse:ifTrue:`, `ifTrue:ifFalse:` and `ifFalse:` also exist

You can read their implementation, this is not magic!

Loops are also message sends

```
1 to: 4 do: [ :i | Transcript << i ]
> 1
> 2
> 3
> 4
```

- to:do: is a message sent to an integer
- Many other messages implement loops: timesRepeat:, to:by:do:, whileTrue:, whileFalse:, ...

With iterators

We ask the collection to perform the iteration on itself

```
#(1 2 −4 −86)
  do: [ :each | Transcript show: each abs printString ; cr ]
> 1
> 2
> 4
> 86
```

Blocks look like functions

fct(x) = x*x+3

```
fct := [ :x | x * x + 3 ]
```

fct(2)

```
fct value: 2
```

Blocks

- Kind of anonymous methods

```
[ :each | Transcript show: each abs printString ; cr ]
```

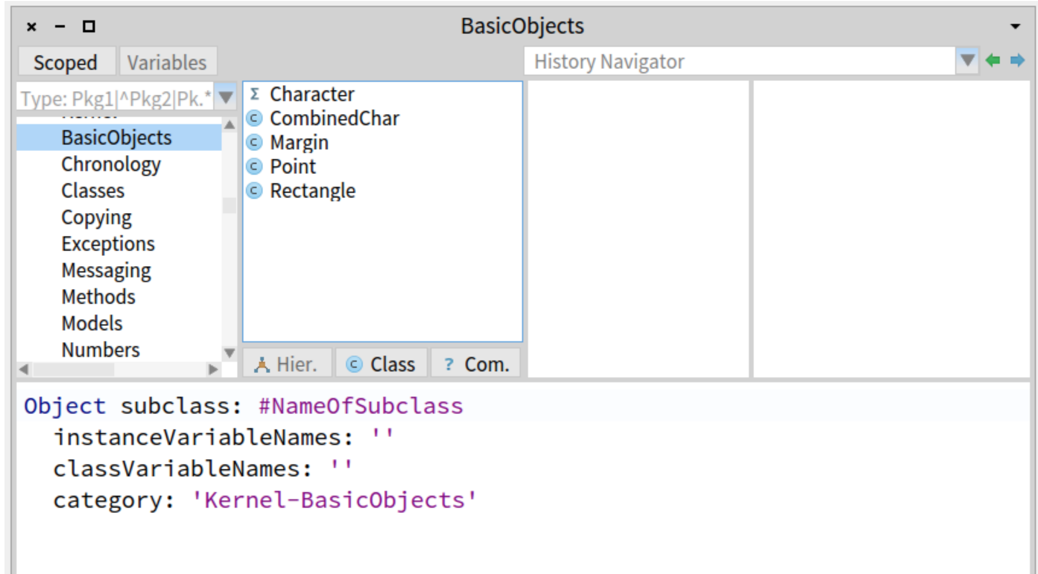
- Are lexical closures
- Are plain objects:
  - can be passed as method arguments
  - can be stored in variables
  - can be returned

Block usage

```
#(1 2 −4 −86)
  do: [ :each | Transcript show: each abs printString ; cr ]
> 1
> 2
> 4
> 86
```

- [ ] delimits the block
- :each is the block argument
- each will take the value of each element of the array

Class definition template



Class definition within the IDE

Point

Scoped | Variables | History Navigator

Type: Pkg1|^Pkg2|Pk.*

BasicObjects
Chronology
Classes
Copying
Exceptions
Messaging
Methods
Models
Numbers

Character
CombinedChar
Margin
Point
Rectangle

Hier. | Class | Com.

-- all --
accessing
arithmetic
comparing
converting
copying
extent functions
geometry
interpolating
point functions
polar coordinates
printing

*
+
-
/
//
<
<=
=
>
>=
\\
abs

```
Object subclass: #Point
  instanceVariableNames: 'x y'
  classVariableNames: ''
  category: 'Kernel-BasicObjects'
```

Method definition

- Methods are public
- Methods are virtual (*i.e.*, looked up at runtime)
- By default return self

```
messageSelectorAndArgumentNames
  "comment stating purpose of message"

 | temporary variable names |
 statements
```

Method definition example

Integer>>#factorial

Scoped | Variables | History Navigator

Packages: Numbers, Objects, Pragmas, Processes, Protocols, Kernel-Tests, Keymapping-Cor, Keymapping-Key

Classes: ExactFloatPrintPolicy, FloatPrintPolicy, InexactFloatPrintPolicy, Magnitude, Number, Float, Fraction, ScaledDecimal, Integer

Hier. | Class | Com.

Protocols: accessing, arithmetic, benchmarks, bit manipulation, comparing, converting, converting-arrays, enumerating, filter streaming, mathematical func

Methods: factorial, gcd:, lcm:, nthRoot:, nthRootRounded:, nthRootTruncated:, raisedTo:modulo:, raisedToInteger:modulo:, sqrt, take:

```
factorial
  "Answer the factorial of the receiver."

  self = 0 ifTrue: [^ 1].
  self > 0 ifTrue: [^ self * (self - 1) factorial].
  self error: 'Not valid for negative integers'
```

Messages summary

3 kinds of messages:

- Unary: Node new
- Binary: 1+2, 3@4
- Keywords: 2 between: 10 and: 20

Message Priority:

- (Msg) > unary > binary > keyword
- Same-Level messages: from left to right

Conclusion

- Compact syntax
- Few constructs but really expressive
- Mainly messages and closures
- Three kinds of messages
- Support for Domain Specific Languages

A course by

S. Ducasse, G. Polito, and Pablo Tesone

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